

# An enumeration of bryophytes collected from North Korea<sup>1</sup>

Cao Tong (曹同) Wu Yuhuan (吴玉环)

Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang 110015, P. R. China)

**Abstract** Bases on studies of bryophytes collected by Cao Tong in August 1997 from North Korea, 81 species belonging to 52 genera, 26 families of mosses and 16 species belonging to 12 genera, 10 families of hepatics are recorded. Among these, 6 species and 1 form are new to bryoflora of the Korean Peninsula. These are: *Campylopus gracilis* (Mitt.) Jaeg., *Grimmia leavigata* (Brid.) Brid., *Okamura hakoniensis* f. *mutiflagellifera* (Okam.) Nog., *Orthotrichum erubescens* C. Muell., *Scapania verrucosa* Heeg., *Schistidium strictum* (Turn.) Loeske ex O. Maort. and *Schistidium subconfertum* (Broth.) Deguchi.

**Key words:** Bryophytes, New record, North Korea

## Introduction

During 20-30 August 1997, the senior author Cao Tong with his four colleagues had the opportunity to visit the Democratic People's Republic of Korea (North Korea) through scientific exchange program between Chinese and Korean Academies of Sciences. The present report is based mainly on more than 100 collections made by him during the field excursion on Mt. Kumgangsan and Mt. Myohyangsan. 81 species belonging to 52 genera, 26 families of mosses and 16 species belonging to 12 genera, 10 families of hepatics are recorded for North Korea. Besides the literature dealing with Korea bryophytes written by Cardot (1904, 1906-1913), Okamura (1915, 1916), Reimers (1931), Noguchi (1954), Osada (1958) and Gao & Chang (1983) etc. were used for present study, the books of "Musci, Hepaticae, Illustrated flora and Fauna of Korea" (Choe 1980); "A list of plants of Korea" (Anonymys. 1983); "Flora of sporophytes of Korea (Bryophytes 1) vol. 8. (Kim 1991)" and the paper of "A checklist of Hepaticae and Anthocerotae in the Korean Peninsula" (Yamada and Choe 1997) have been used as a basis when recording taxa as new for the Korean peninsula.

The following taxa are new records for the Korean peninsula.

- Campylopus gracilis* (Mitt.) Jaeg.
- Grimmia leavigata* (Brid.) Brid.
- Okamura hakoniensis* f. *mutiflagellifera* (Okam.) Nog.
- Orthotrichum erubescens* C. Muell.
- Scapania verrucosa* Heeg.
- Schistidium subconfertum* (Broth.) Deguchi.
- Schistidium strictum* (Turn.) Loeske ex O. Maort.

An enumeration of bryophytes is presented herewith. All specimens collected by Cao Tong on 20-30 August 1997 are deposited in IFPBH. The specimens cited "M" and "K" were collected from Mt. Myohyangsan and Mt. Kumgangsan respectively. One asterisk means that the species has not been reported earlier from the Korean Peninsula.

## Musci

### Family Sphagnaceae

1. *Sphagnum subsecundum* Nees. --on rock K37.

### Family Polytrichaceae

2. *Atrichum undulatum* (Hedw.) P. Beauv. --on rock K40, K65.
3. *Pogonatum spinulosum* Mitt. --on soil M35, K45.
4. *P. urnigerum* (Hedw.) P. Beauv. --on rock K24, K34.

### Family Fissidentaceae

5. *Fissidens adelphinus* Besch. --on soil M35.
6. *F. dubius* P. Beauv. --on rock M8.
8. *F. bryioides* Hedw. --on soil M39.

### Family Ditrichaceae

9. *Ceratodon purpureus* (Hedw.) Brid. --on soil M2.

### Family Dicranaceae

10. *Brothera leana* (Sull.) C. Muell. --on trunk M31.
11. *Campylopus umbellatus* (Am.) Par. --on rock K40.
12. *C. fragilis* (Brid.) B.S.G. --on rock K43.
- \*13. *C. gracilis* (Mitt.) Jaeg. --on rock K42. This species is distinguished by having costa consisting of thin-walled cells with distinct papillae on dorsal surface. The plants mixed with *Leucobryum glaucum*. (Gao 1994).
14. *Dicranella heteromalla* (Hedw.) Schimp. --on soil M35.
15. *Dicranodontium denudatum* (Brid.) Britt. ex Williams. --on rock K27.
16. *Dicranum montanum* Hedw. --on tree trunk K65.
17. *Oncophorus wahlenbergii* Brid. --on tree trunk K65.

### Family Leucobryaceae

18. *Leucobryum glaucum* (Hedw.) Aongstr. --on rock K42, K47, K50.
19. *L. neilgherrense* C. Muell. --on rock K51.

### Family Pottiaceae

20. *Hyophila amblyphylla* Card. --on rock K11, K65.
21. *Trichostomum spirale* Zand. --on rock K14, K30, M20.
22. *T. planifolium* (Dix.) Zand. --on rock K15, K68.

<sup>1</sup> The project was funded by the Opened Research Station of Mt. Changbai Forest Ecosystems, the Chinese Academy of Sciences

Family Ptychomitriaceae

23. *Ptychomitrium fauriei* Besch. --on rock in forest K13, K19.  
24. *P. linearifolium* Reim. --on rock M9.  
25. *P. sinense* (Mitt.) Jaeg. --on rock M3, K14.

Family Grimmiaceae

- \*26. *Grimmia leavigata* (Brid.) Brid. --on dried rock K47. The small blue green plants in dense tufts are distinctive and different from the normal plants of *Grimmia leavigata* that I have seen. The characters of leaf and cell are identical to those of *G. leavigata*. Since the sporophytes are not available, further study and collection are necessary.  
27. *G. pilifera* P. Beauv. --on rock M3, M9, M30, M34, K4, K45.  
28. *Racomitrium anomodontoides* Card. --on rock K32, K38, K40.  
29. *R. fasciculare* (Hedw.) Brid. --on rock K23, K41.  
30. *R. japonicum* Dozy et Molk. --on sandy soil. K19, K64. Frisvoll (1983) first recorded this species for Korea. It was often misidentified as *R. canescens*. The difference between these two species is distinct. (Frisvoll 1983, Vitt et al. 1993)  
31. *R. laetum* Besch. --on rock K33.  
\*32. *Schistidium strictum* (Turn.) Loeske ex O. Maort. --on rock M20. This species is different from *S. apocarpum* in having the button-like papillae at the back of the costa. (Cao & Vitt 1986)  
\*33. *S. subconfertum* (Broth.) Deguchi --on rock in forest of *Pinus densifolia* K14. The small plants and deeply immersed capsules make this species easily distinguished from *S. apocarpum*. The plants in dense tufts mixed with *Grimmia pilifera* and *Ptychomitrium sinense*. (Cao & Vitt 1986)

Family Funariaceae

34. *Funaria hygrometrica* Hedw. --on soil M2.

Family Bryaceae

35. *Brachymerium nepalense* Hook. in Schwaegr. --on trunk M25.  
36. *Bryum pallescens* Schleich. ex Schwaegr. --on rock K56, M2.  
37. *B. argenteum* Hedw. --on soil M2, K67.  
38. *B. pseudotriquetrum* (Hedw.) Gaertn., Meyer & Schreb. --on rock by water-flow, K57, K60, K62.

Family Mniaceae

39. *Plagiomnium cuspidatum* (Hedw.) Kop. --on rock M7, M9, M28.  
40. *P. maximowiczii* (Lindb.) Kop. --on rock M10.  
41. *P. rostratum* (Schrad.) Kop. --on rock M13, M18.  
42. *Rhizomnium punctatum* (Hedw.) Kop. --on ground K36.

Family Bartramiaceae

43. *Philonotis lancifolia* Mitt. --on rock K15, K16.

Family Glyphomitriaceae

44. *Glyphomitrium humillimum* (Mitt.) Card. --on tree trunk K3.

Family Orthotrichaceae

45. *Macromitrium japonicum* Dozy et Molk. --on tree trunk K7.  
46. *Orthotrichum affine* Schrad. ex Brid. --on tree trunk K1.  
\*47. *O. erubescens* C. Muell. --on tree trunk K2. This species is distinguished by having small plants, narrowly lingulate leaves with obtuse apex; thin-walled, elongate cell in a single row along the basal margins; and emergent capsules. The

plants of this species are mixed with *Othotrichum speciosum* and *Fabronia ciliaris*.

48. *O. speciosum* Nees. --on trunk of old tree K2, K3.

Family Hedwegiaceae

49. *Hedwigia ciliata* (Hedw.) P. Beauv. --on rock K67.

Family Fabroniaceae

50. *Fabronia ciliaris* (Brid.) Brid. --on tree trunk K2.  
51. *Schwetschkeopsis fabronia* (Schwaegr.) Broth. --on tree trunk M15, K21.

Family Leskeaceae

- \*52. *Okamura hakoniensis* f. *mutiflagellifera* (Okam.) Nog. --on rock M25. the plants with slender flagellate branches at tip of the stem are distinctive character of this form.

Family Thuidiaceae

53. *Anomodon minor* (Hedw.) Fuernr. --on tree trunk M15.  
54. *A. rugelii* (C. Muell.) Keissl. --on rock M8, M28.  
55. *A. thraustus* C. Muell. --on rock M38.  
56. *Haplodadium angustifolium* (Hamp. et C. Muell.) Broth. --on rock by water-flow K36.  
57. *H. microphyllum* (Hedw.) Broth. --on rotten log M36.  
58. *Haplomenium longinerve* (Broth.) Broth. --on rock K26.  
59. *H. triste* (Ces.) Kindb. --on tree trunk M; on rock M21, K30; on rock by stream M27.  
60. *Herpetineuron toccoeae* (Sull. et Lesq.) Card. --on rock M1, M21.  
61. *Miyabea rotundifolia* Card. --on tree trunk K22.  
62. *Thuidium recognitum* var. *delicatulum* (Hedw.) Warnst. --on rock M16.

Family Amblystegiaceae

63. *Calliergonella cuspidata* (Hedw.) Loesk. --on rock by water-flow M37.  
64. *Sanionia uncinata* (Hedw.) Loesk. --on rock K32.

Family Brachytheciaceae

65. *B. plumosum* (Hedw.) B.S.G. --on rock M20, M30, K16, K19.  
66. *B. reflexum* (Stark.) B.S.G. --on rock M12, M34.  
67. *Myuroclada maximowiczii* (Borszcz.) Steere et Schof. --on rock M12.  
68. *Scleropodium coreense* Card. --on wet rock by stream M27.

Family Entodonaceae

69. *Entodon luridus* (Griff.) Jaeg. --on ground K10, K36.  
70. *E. flavescens* (Hook.) Jaeg. --on rock in forest K9.  
71. *E. sullivantii* var. *versicolor* (Besch.) Mizushima --on tree trunk K1, K5, K67, M11. on rock M9, M14.

Family Plagiotheciaceae

72. *Plagiothecium nemorale* (Mitt.) Jaeg. --on rock M12, K53.

Fam. Sematophyllaceae

73. *Brotherella fauriei* (Card.) Broth. --on fallen log. K6, K44; on thin soil over rock K18.

Family Hypnaceae

74. *Homomallium connexum* (Card.) Broth. --on rock M30.  
75. *Hypnum fertile* Sendt. --on rock K34.  
76. *H. plumaeforme* Wils. --on rock K37, K54, K55.

77. *Breidleria pratensis* (Hartm. in Spruce) Loesk. --on rock M23.  
 78. *Pylaisiella polyantha* (Hedw.) Grout. --on rock K63, M26, M31.  
 79. *Taxiphyllum girardii* (C. Muell.) Fleisch. --on rock M13, M25.

#### Family Hylocomiaceae

80. *Hylocomiastrum pyrenaicum* (Spruc.) Fleisch. --on rock K32.  
 81. *Pleurozium schreberi* (Brid.) Mitt. --on rock K52.

### Hepaticae

#### Family Calypogeciaceae

82. *Calypogeia arguta* Nees et Mont. --on thin soil over rock K24.  
 83. *C. trichomanis* (L.) Corda. --on rock K27; on soil M35.

#### Family Jungermanniaceae

84. *Jamesoniella autumnalis* (DC.) Steph. --on rock by water-flow K59.

#### Family Gymnomitriaceae

85. *Marsupella commutata* (Limp.) Bernet. --on wet rock K29.

#### Family Scapaniaceae

86. *Diplophyllum taxifolium* (Wahl.) Dum. --on rock K38.  
 87. *Scapania apiculata* Spruce --on rock K38.  
 88. *S. stephni* K. Muell. --on rock by river K25, K37.  
 \*89. *S. verrucosa* Heeg. --on rock K34. This species is distinguished by having distinctively papillose leaf cells and decurrent base of lobes. It is mixed with *Campylopus umbellatus*, *Pogonatum urnigenum* and *Hypnum fertile*.

#### Family Lophocoleaceae

90. *Chiloscyphus japonicus* (Steph.) Engel. & Schust. --on wet rock K58.

#### Family Cephaloziaceae

91. *Cephalozia catenulata* (Hub.) Lindb. --on wet rock K29.

#### Fam. Radulaceae

92. *Radula cavifolia* Hampe --on rock K15.

#### Family Porellaceae

93. *Porella vernicosa* Lindb. --on rock M17.

#### Family Frullaniaceae

94. *Frullania densiloba* Steph. ex Evans --on trunk of old tree K3.  
 95. *F. muscicola* Steph. --on tree trunk K1.

#### Family Lejeuneaceae

96. *Cololejeunea ornata* Evans --on rock K66.  
 97. *Trocholejeunea sandvicensis* (Gott.) Mizut. --on tree trunk K6.

### Acknowledgments

We acknowledge the Chinese and Korean Academies of Sciences for support of Cao Tong's visit to North Korea in August 1997 through the exchange program between two Academies. The senior author appreciates Dr. Ryu U.-G.

and Dr. Chui M.-H., Korean Academy Sciences, for their hospitalities during his visit. Thanks are due to Prof. Gao Chien, Institute of Applied Ecology, Academia Sinica, Shenyang for his help in identification of some specimens.

### References

1. Anonymys. 1983. A list of plants of Korea. pp. 1-318. Pyongyang. (in Korean)
2. Cao, T. & D. H. Vitt. 1986. A taxonomic revision and phylogenetic analysis of *Grimmia* and *Schistidium* (Bryopsida, Grimmiaceae) in China. Journ. Hattori Bot. Lab. 61: 123-247.
3. Cardot, J. 1904. Premiere contribution a la flore bryologique de la Coree. Beih. Bot. Centralbl. 17: 1-44.
4. Cardot, J. 1906. Mousses de l'île Formose. Beih. Bot. Central 19: 85-148.
5. Cardot, J. 1907. Mousses nouvelles du Japon et de Coree. Bull. Herb. Boissier 2. ser. 7: 709-718.
6. Cardot, J. 1908. Mousses nouvelles du Japon et de Coree. Bull. Herb. Boissier 2. ser. 8: 331-336.
7. Cardot, J. 1909. Mousses nouvelles du Japon et de Coree. Bull. Soc. Bot. Geneve 2. ser. 1: 120-132.
8. Cardot, J. 1911. Mousses nouvelles du Japon et de Coree. Bull. Soc. Bot. Geneve 3. ser. 3: 275-294.
9. Cardot, J. 1912. Mousses nouvelles du Japon et de Coree. Bull. Soc. Bot. Geneve 2. ser. 4: 378-387.
10. Cardot, J. 1913. Mousses nouvelles du Japon et de Coree. Bull. Soc. Bot. Geneve 5: 317-324.
11. Choe, D.M. 1980. Musci, Hepaticae, Illustrated flora and fauna of Korea 24: 1-753. Soul. (in Korean)
12. Frisvoll, A. A. 1983. A taxonomic revision of the *Racomitrium canescens* group (Bryophyta, Grimmiaceae). Gunneria 41: 1-181.
13. Gao, C. (chief. ed.) 1994. Flora Bryophytarum Sinicorum. vol.1. 368pp. Science Press, Beijing (in Chinese)
14. Gao, C. & K.C. Chang. 1983. Bryophyte of North Korea. Bull. Bot. Res. 3(4): 118-131. (in Chinese)
15. Kim, Y.-H. 1991. Sporephyte flora of Korea vol. 8. (Bryophytes) pp. 1-222. Pyongyang. (in Korean)
16. Noguchi, A. 1954. Notulae Bryologicae V. A list of mosses from Manchuria and North Korea. Journ. Hattori Bot. Lab. 12: 27-33.
17. Okamura, S. 1915. Contributions novae ad Florem bryophyton Japonicam. I. Journ. College Sci. Imp. Univ. Tokyo, 36 (Ant.7): 1-51.
18. Okamura, S. 1916. Contributions novae ad Florem bryophyton Japonicam. II. Journ. College Sci. Imp. Univ. Tokyo, 38 (Ant.4): 1-97.
19. Osada, J. 1958. An additional list of mosses from North Korea. Journ. Hattori Bot. Lab. 19: 60-66.
20. Reimers, H. 1931. Ein Beitrag zur Moosflora von Korea. Hedwigia LXX: 359-372.
21. Vitt, D. H., Cao, T. & A. A. Frisvoll. 1993. *Racomitrium leptomoides* and *R. szuchuanicum*, new synonyms of *R. japonicum* Dozy & Molk. (Bryopsida). Nova Hedwigia 57(3-4): 457-461.
22. Yamada, K. & D. M. Choe. 1997. A checklist of Hepaticae and Anthocerotae in the Korean Peninsula. Journ. Hattori Bot. Lab. 81: 281-306.

(Responsible Editor: Chai Ruih)